1991-435
University of Alberta Library
0 1620 3415269 2

SCIENCE 7

MODULE 1:
CHARACTERISTICS OF LIVING THINGS

Distance Learning

Alberta EDUCATION

Science 7

Module 1

CHARACTERISTICS OF LIVING THINGS

Alberta
EDUCATION

ACKNOWLEDGEMENTS

This module has been based on **Science Directions 7** by John Wiley & Sons/Arnold Publishing Ltd., 1989. Program consultant was Douglas A. Roberts. The author team for the complete text included: Wilson C. Durward, Eric S. Grace, Gene Krupa, Mary Krupa, Alan J. Hirsch, David A.E. Spalding, Bradley J. Baker, Sandy M. Wohl. Contributing author was Jean Bullard. Portions of **Science Directions 7** have been used throughout the Module Booklet and have been adapted in a variety of ways.

Cover photographs courtesty of Dave Mussell, Edmonton.

Science 7
Student Module
Module 1
Characteristics of Living Things
Alberta Distance Learning Centre
ISBN No. 0-7741-0122-9

ALL RIGHTS RESERVED

Copyright ® 1991, the Crown in Right of Alberta, as represented by the Minister of Education, Alberta Education 11160 Jasper Avenue, Edmonton, Alberta, T5K 0L2.
All rights reserved. Additional copies may be obtained from the Learning Resources Distributing Centre.

No part of this courseware may be reproduced in any form including photocopying (unless otherwise indicated), without the written permission of Alberta Education.

Every effort has been made both to provide proper acknowledgement of the original source and to comply with copyright law. If cases are identified where this has not been done, please notify Alberta Education so appropriate corrective action can be taken.

UNIVERSITY LIBRARY

Welcome to Science 7!

We hope you'll find this course interesting and fun.

To make your learning a bit easier, a teacher will help guide you through the material.

So whenever you see this icon,

turn on your audiocassette and listen.

Digitized by the Internet Archive
in 2017 with funding from
University of Alberta Libraries

https://archive.org/details/science701albe_3

Contents

OVERVIEW 1
Evaluation 2

SECTION 1:
LIVING THINGS 3
Activity 1: Understanding by Observing 4
Activity 2: Living, Non-Living, or Dead 5
Activity 3: What Living Means 8
Activity 4: Living or Non-Living 9
Follow-up Activities 12
Extra Help 12
Enrichment 14
Conclusion 16
Assignment 16

SECTION 2:
GROWTH PATTERNS 17
Activity 1: Looking for Patterns 18
Activity 2: Comparing Growth 19
Activity 3: Other Growth Patterns 21
Activity 4: Reproduction 23
Activity 5: Testing Hypotheses 24
Activity 6: Controlled Experiments 28
Activity 7: Life Cycles 29
Follow-up Activities 31
Extra Help 31
Enrichment 33
Conclusion 34
Assignment 34

SECTION 3:

VARIETY OF LIFE 35
Activity 1: Understanding Variation in Living Things 36
Activity 2: Variation Within a Species 38
Activity 3: Classifying Organisms 41
Follow-up Activities 45
Extra Help 45
Enrichment 51
Conclusion 58
Assignment 58

SECTION 4:

STRUCTURAL ADAPTATIONS 59
Activity 1: Making Inferences 60
Activity 2: Adaptations in Animals 61
Activity 3: Adaptations in Plants 64
Activity 4: Camouflage 69
Follow-up Activities 72
Extra Help 72
Enrichment 73
Conclusion 74
Assignment 74

SECTION 5:

BEHAVIOURAL ADAPTATIONS 75
Activity 1: Overcoming Cold Climates 76
Activity 2: Migration 77
Activity 3: Hibernation 78
Follow-up Activities 79
Extra Help 79
Enrichment 79
Conclusion 80
Assignment 80

SECTION 6:

STIMULUS AND RESPONSE 81
Activity 1: Understanding Stimulus and Response 82
Activity 2: Instinctive and Involuntary Responses 86
Activity 3: Voluntary or Involuntary? 89
Activity 4: Experiments Involving Digger Wasps 91
Activity 5: Stickleback Responses 92
Activity 6: Learned Responses 93
Follow-up Activities 94
Extra Help 94
Enrichment 97
Conclusion 98
Assignment 98

MODULE SUMMARY 99

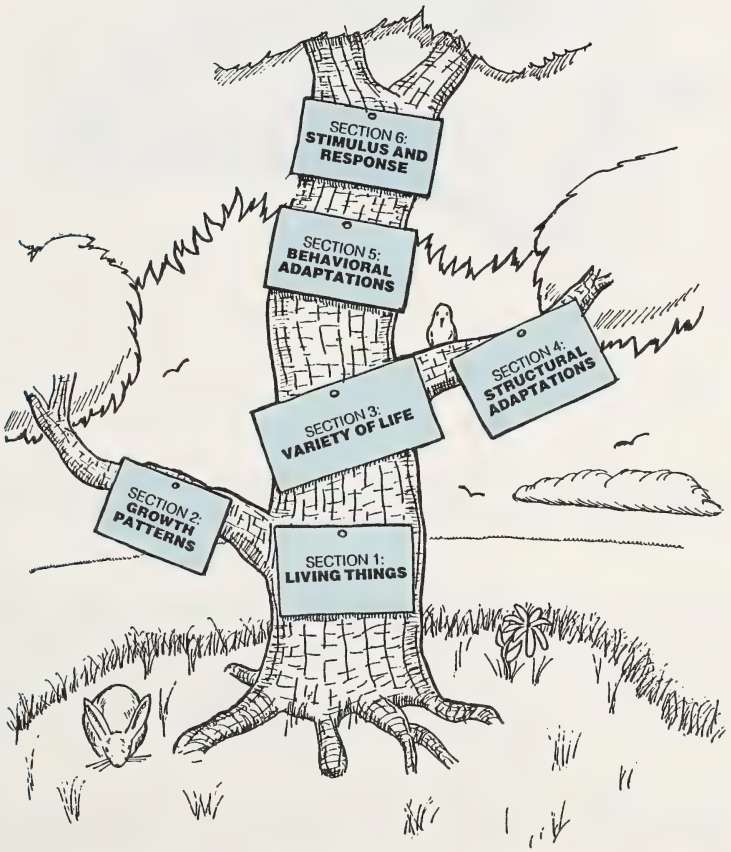
APPENDIX 101
Glossary 103

OVERVIEW

How can you tell if something is alive? Think about it. Do you often come up with the same reasons for deciding if different things are living? Sometimes it seems easy to tell; but what about a campfire, a babbling brook, the wind blowing, or a leaf falling from a tree?

In this module you will examine ways to distinguish between living and non-living things. You will also be investigating the features of living things such as how growth occurs in patterns, how living things respond to changes around them, and how living things survive. Like scientists, you will be using your observation and interpretation skills to increase your knowledge of living things.

Characteristics of Living Things


SECTION 6: STIMULUS AND RESPONSE
SECTION 5: BEHAVIORAL ADAPTATIONS
SECTION 4: STRUCTURAL ADAPTATIONS
SECTION 3: VARIETY OF LIFE
SECTION 2: GROWTH PATTERNS
SECTION 1: LIVING THINGS

Evaluation

Your mark in this module will be determined by your work in the Assignment Booklet. You must complete all assignments. In this module you are expected to complete six section assignments.

The assignment breakdown is as follows:

Section 1 Assignment	**15%**
Section 2 Assignment	**17%**
Section 3 Assignment	**15%**
Section 4 Assignment	**15%**
Section 5 Assignment	**15%**
Section 6 Assignment	**23%**
TOTAL	**100%**

Section

1

Living Things

You are familiar with squirrels and know that a squirrel is a living thing. But what about things you are not familiar with? How can you tell if they are living?

Examine the photographs shown under A Close Look at Life on the title pages for Unit One of your textbook, *Science Directions 7*. A huge whale jumping out of the sea is a magnificent sight. It is easy to tell it is alive! Bears on the prowl and geese waddling along a lakeshore are also obviously alive. How about the objects shown in the other photographs? Are they alive?

This section will help you understand the difference between things that are living and non-living.

7 Science Directions

Activity 1: Understanding by Observing

How do you know if something is living? Do you poke it with a stick? Do you smell it? Do you look at it for a long time to see if it moves? All of these methods could be correct – just be careful not to poke a sleeping bear with a stick!

Observation: information gathered by using the five senses

Questions in science start with someone being curious. The question about the difference between living and non-living is a good example. Finding answers in science starts with making observations. An **observation** is a statement about something based on one or more of the five senses. Some examples of observations are

a. The sun is shining brightly today.
b. The clock in the hall goes tick-tock, tick-tock.
c. Juice tastes too sour.
d. Silk feels very smooth.
e. The garbage pail stinks.

List your five senses. Then match each of the previous examples with one of the senses by writing the letter of the example in the space provided.

	SENSE	EXAMPLE
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

Check your answers with your learning facilitator.

Activity 2: Living, Non-Living, or Dead

Living: being alive or having been alive

Non-living: never having been alive

Through observation you can often tell if something is **living** or **non-living**. But how do you know for sure? What is it about living things that makes them different from non-living things?

Consider a few examples to see how much you already know about what is living and what is not. Suppose that while walking down the road you saw each of the following:

- a rock rolling down a hill
- a gopher running across the road
- the body of a gopher lying by the side of the road

Which of these is living?

With a bit of thought you should understand that

Alive: showing signs of life

Dead: no longer alive

- a rock is a non-living object because it never was **alive**
- a gopher running across a road is a living animal
- the lifeless body of a gopher on the side of the road was once alive, but is now **dead**

Do either Part A or Part B.

Part A involves classifying objects in a picture.
Part B involves groups of students making lists of objects and then finding out which group is quickest in classifying the objects.

Part A

Note: You do not need to complete Part A if you wish to do Part B.

Study the following picture. Decide if the objects shown in the picture are most likely living, non-living, or dead. Then write the name of the object in the appropriate column in the chart.

Living	Non-Living	Dead

Discuss your answers with your learning facilitator.

Part B

Note: You do not need to complete Part B if you have already done Part A.

Steps to Follow

Step 1: Sit down with a group of other students, and on a separate piece of paper make a list of at least twenty different things. Try to think of as many different kinds of things as you can.

Step 2: Divide your list of things into groups by filling in the following chart. The goal of this activity is to see which person can decide, in the least amount of time, what category each thing on the list fits into.

Living	Non-Living	Dead

Step 3: Compare answers with the other students to see if everyone agrees that the fastest group has correctly classified everything.

Discuss your answers with your learning facilitator.

Activity 3: What Living Means

You have been asked many questions in this section, but few answers have been given. How can you tell if something is alive? What do you know about living things? Is bread mould alive? Is a campfire alive? There are no simple answers, but soon you will find out how scientists have answered these questions.

Organism: a living thing; anything that is alive

A new word that will be very helpful to you is **organism**. An organism is a living thing. Accuracy and precision are important in science. The word *thing* has many meanings. You should now use the word *organism* when referring to a living thing.

Characteristic: a feature that is common to all members of a group

Organisms can be very different from one another. For example, whales, birds, and trees are very different from each other, yet they are all organisms. What **characteristics** of life do they all share?

Read pages 2 to 8 of your textbook, *Science Directions 7*. On these pages five characteristics of organisms are described. To be classified as living, something must have all five of these characteristics.

List the five important characteristics that all organisms have in common.

- _____
- _____
- _____
- _____
- _____

Check your answers with your learning facilitator.

Activity 4: Living or Non-Living

Now that you know the characteristics of organisms, you can give reasons why something should be called living. If something does not have all five of the characteristics you learned about in the previous activity, it is classified as non-living.

Classify the things in the following charts as living or non-living. Then give reasons for your decisions. For the context of this activity classify something as living if it currently has all five characteristics, or if it has at one time had all five characteristics of living things. The first two have been done as examples for you.

Thing	Living	Non-Living	Reason
dandelion	x		Dandelions: • grow bigger • move toward light • make seeds which create more dandelions • shrivel in response to weed killer • make their own food
campfire		x	Campfires do not make their own food, and they do not take in food. Fuel must be supplied to the fire.
earthworm			
maple tree			

Thing	Living	Non-Living	Reason
diamond			
bean seed			
banana (cut from tree)			
burning candle			

Thing	Living	Non-Living	Reason
leaf on a poplar tree			
sun			
salt crystal			
strand of hair			

Check your answers with your learning facilitator.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

The world you live in consists of hundreds upon thousands of different things. All of these things can be classified into one of the following three categories:

- living
- non-living
- dead

You can quickly classify most things into one of these three categories. But what characteristics are common to all living things? Why will something fit into one of the three categories, but not into the other two?

Which objects in this picture are alive, and which are not alive? The girl and the flower are alive and the rock and clouds are not. But what are the reasons for classifying the objects in this way? This isn't as easy as it first looks.

Movement is one characteristic of living things. A flower stays fairly still, but a cloud can move around. A girl can walk around, and a rock can roll down a hill. Moving by itself is not enough to define living.

Growth is another characteristic of living things. A rock usually stays about the same size, but both the flower and the girl will grow. Some clouds (like a thundercloud) can grow larger very quickly, but they are not alive. Growth by itself is not enough to define living.

Scientists call living things organisms. To be classified as an organism, something must have all of the following five characteristics.

- All organisms grow; from young to old and from small to large.
- All organisms move; they move through their own ability.
- All organisms reproduce; they produce new organisms.
- All organisms respond to stimuli; this means they react to changes in the environment.
- All organisms make or take in food; this is their energy source.

An object that does not have all five characteristics is considered non-living. But what are the characteristics of dead things? Something that was once alive but is no longer living is called dead. Non-living things never were alive and never will be alive.

1. What are the three categories into which all things can be classified?

   - _____
   - _____
   - _____

2. What is an organism? _____

   _____

3. What are the five characteristics of all living things?

   - _____
   - _____
   - _____
   - _____
   - _____

4. Classify each of the following as living or non-living. Give a reason for your answer. The first is done for you as an example.

   a. human: *living*

      Humans have all five characteristics of living things.

   b. flower: _____

      _____

   c. rock: _____

      _____

   d. cloud: _____

      _____

   e. housefly: _____

      _____

   f. book: _____

      _____

Enrichment

You can directly observe all the characteristics of living things you have been studying in this section. One other characteristic of living things is more difficult to observe, but it is just as important.

Examine the diagrams on page 9 of your textbook, *Science Directions 7*. They show what you would see if you looked through a microscope at a small part of some living thing.

Although the shapes vary, you can see that living things are made up of many tiny units. When scientists first observed this they called the regularly-shaped units *cells*. All things that are living, or have been living, are made up of cells. Non-living things are not made up of cells. When scientists say something is dead they mean that it once had life.

1. How could you use a microscope to help you decide if something should be classified as non-living or dead?

_____

_____

_____

2. What characteristics of living things have dead things lost?

_____

_____

_____

3. What characteristics of living things do dead things still have?

_____

_____

_____

Check your answers with your learning facilitator.

Conclusion

In this section you have learned that to answer questions in science you should start with observations. To classify something as living, you should be able to observe the five characteristics that make organisms different from something non-living. Dead things were once living, but they are no longer alive.

Assignment Booklet

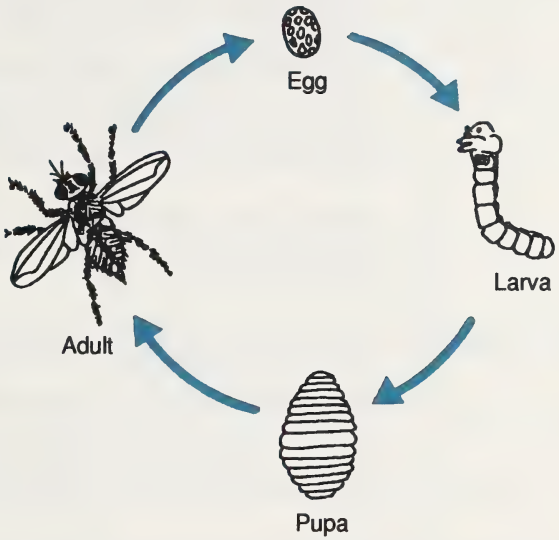
ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 1.

Section

2

Growth Patterns



Life Cycle of the Housefly

In this section you will learn more about one characteristic of life – growth. Growth means more than just getting bigger. It also means change. Organisms go through many changes during their lifetime.

Some organisms change so much that they seem to be completely different organisms. A good example of this is a fly. Where do flies come from? It seems that as soon as the weather becomes warm, flies suddenly appear. Have you ever seen a tiny baby fly?

Think about garden seeds. Does the shape and size of different seeds give you any ideas about what the fully-grown plants will look like?

Scientists have developed explanations about the growth patterns of different types of organisms. This section will increase your understanding about the variety of growth patterns, and how some of the explanations were developed. You will compare life cycles, and get practice in writing hypotheses to answer questions about growth patterns.

Activity 1: Looking for Patterns

You are probably curious about how much you will change and grow during the next five years. Curiosity has led scientists to develop explanations about the variety of growth patterns that different organisms have.

One obvious variation is in how fast organisms grow. Think about yourself. Have you grown at a steady rate or in spurts? If you grew in spurts, when did they occur? To find out when rapid rates of growth usually occur, read page 14 of your textbook, *Science Directions 7*.

7 Science Directions

Making a graph is one way to find out if a pattern exists. Graphing can also help you compare patterns. Looking for patterns and comparing patterns is how scientists use graphs.

Refer to page 15 of your textbook. Examine Table 3 and the line graph showing Peter Boyko's growth pattern. Note that in the table the numbers come in pairs; Peter's age and height at that particular age. The graph shows each number pair with just one point. The first point shows Peter's height at birth (60 cm at 0 years). The second point shows Peter's height at age 1 (75 cm at 1 year). Other points represent the relationship of Peter's height to his age up to age sixteen.

1. What does the shape of the line on the graph show you about Peter's growth pattern?

_____

_____

_____

2. Between which birthdays did Peter grow the most?

_____

_____

3. How many centimetres did Peter grow in the year of his growth spurt?

_____

_____

4. Did Peter's growth spurt occur at the same time as that of most boys? Or was it earlier or later?

_____

_____

_____

5. a. When was Peter's slowest growth period?

_____

_____

b. Why do you think Peter's growth was slow during that time?

_____

_____

Check your answers with your learning facilitator.

Activity 2: Comparing Growth

Remember Peter's growth curve? While the rate of growth was much greater in some years than in others, it was a fairly smooth progression. For some organisms, growing is more a matter of stops and starts.

Read page 16 of the textbook, *Science Directions 7*. Examine the graph which shows the growth of a small insect called the water boatman. This graph shows the measurements that Erica Bartlett took over a period of sixty days. The growth curve of the water boatman looks very different from Peter's growth pattern. Where the line is almost flat, the water boatman is growing very little. Where the line is vertical, the water boatman seems to have grown a great deal in one day!

7 Science Directions

A Water Boatman

1. The water boatman is an arthropod. This means that it wears its skeleton on the outside of its body like a lobster or a crab. Think of what you would have to do to grow if you were encased in such armour. Suggest a possible reason why the water boatman grows quite a bit in a short period of time and then does not grow at all.

2. How is the growth pattern of the water boatman similar to Peter's growth pattern?

3. How is the growth pattern of the water boatman different from Peter's growth pattern?

Check your answers with your learning facilitator.

7 Science Directions

Activity 3: Other Growth Patterns

Peter and the water boatman did not change much in appearance as they grew bigger. Horses and grasshoppers, illustrated on page 19 of the textbook, *Science Directions 7*, are other examples of organisms that do not change much in appearance as they grow.

Some organisms change so much that they look entirely different as they grow to the adult stage. The Colorado potato beetle, illustrated on page 20 of your textbook, is a good example. It goes through four stages: egg → larva → pupa → adult.

A frog is another example of an organism that changes in appearance as it grows to the adult stage. Examine the following diagrams of the different stages of a frog. Try to decide what order these stages should be in as a frog develops from an egg into an adult frog.

a. tadpole (gills covered)

b. young frog

c. young frog with tail

d. hind legs develop

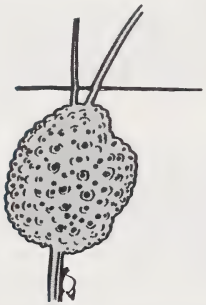
e. front legs break through (breathing begins)

f. gill stage of tadpole

1. In the blank space provided, write the letter of each stage to show the correct order of progress from an egg to an adult frog.

First Stage Last Stage

egg mass _____ _____ _____ _____ _____ _____ adult frog



2. You probably used size as one clue to help put the diagrams in the correct order. What other observations helped you?

_____

_____

Check your answers with your learning facilitator.

Activity 4: Reproduction

You have seen that organisms grow at different rates during their lifetimes. Some organisms change size but keep the same general appearance during their lives, while others change appearance so much that they look like completely different organisms.

You have looked at growth patterns from the egg stage to the adult stage. Once the adult dies, its life is over. If all the organisms of the same kind (species) grew to become adults, then died, there would be no organisms of that **species** left. However, organisms in the adult stage are able to start new organisms growing through **reproduction**. Reproduction can be thought of as the process that starts the growing of an organism.

Species: a group of organisms that closely resemble each other, and can reproduce new organisms of the same kind

Reproduction: the process of organisms producing offspring similar to themselves

Read pages 24 and 25 of the textbook, *Science Directions 7*, for information on the many ways that organisms reproduce.

Just as organisms show wide variety in growing patterns, they also show wide variety in how they reproduce. Some organisms must mate with others of their own kind (species). Others can reproduce themselves by splitting in half. But among living things, plants have the greatest variety of ways to produce more plants like themselves.

Plants that reproduce by pollination make seeds. When you buy seeds in a package they are not growing and will not grow at all if you leave them in the package. When planted, the seeds begin to form a new plant. But how does a seed know when to start growing? Is the seed alive?

If you are curious about these questions, you can understand how a scientist feels at the beginning of an **investigation**. The first thing you should do is try to identify the differences between a seed in a package and a planted seed. The differences, or changes, are called **variables**. Any change, from a seed in a package to a seed planted in the ground, could be an important variable that starts the growth of the seed.

Investigation: the process of finding information about something by searching carefully or examining in detail

Variable: a condition that is allowed to change in an experiment

You will now start your scientific investigation into what causes a seed to begin to grow. You will identify variables that might start seed growth. Remember that a variable is a thing that varies or changes.

1. List three variables that might somehow indicate to a seed that it should start to grow. Write the reason why you think each of these variables may prompt seed growth.

   - variable: _____
   - reason: _____

   _____

   - variable: _____
   - reason: _____

   _____

   - variable: _____
   - reason: _____

   _____

Discuss your answers with your learning facilitator.

Activity 5: Testing Hypotheses

Hypothesis: a statement to explain a natural event or to predict what will happen in a certain situation
The plural is hypotheses.

Controlled experiment: a science investigation in which only one variable is changed by the experimenter
This is sometimes called a fair test.

Are you curious about what makes a seed begin to grow? Scientists spend much of their time trying to find answers to questions like this. When you wrote answers for Activity 4 you were making **hypotheses**. Scientists also make hypotheses and then they do experiments to test their ideas.

Perhaps you thought that soaking a seed in water would help a seed start to grow. You can try it. To help you do this test in a scientific way, the following instructions will guide you in doing a **controlled experiment**.

Read the remainder of Activity 5 carefully before you start the experiment.

Hypothesis

For this activity you will test the following hypothesis:

Soaking bean seeds in water will help the seeds start to grow.

Materials You Need

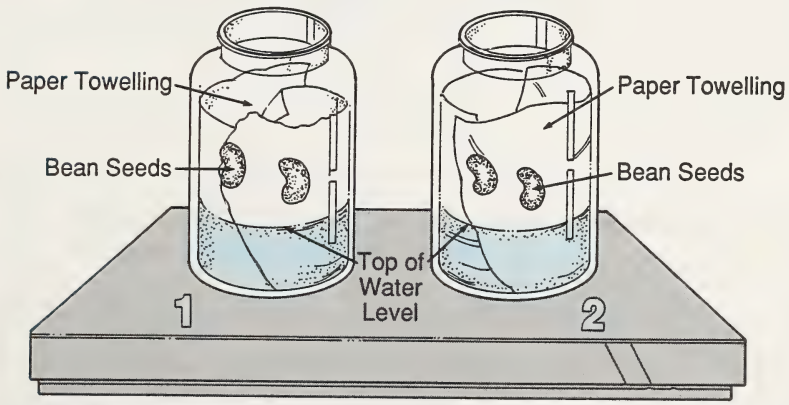
- two small glass jars (or small beakers)
- marking pencil
- paper towels
- four bean seeds
- small pie plate or bowl

Steps to Follow

Step 1: Soak two bean seeds overnight in water in the pie plate or bowl. Do not soak the other two seeds.

Step 2: Stuff paper towels into the jars. Pack them tightly so that you can place the bean seeds between the paper towels and the sides of the jars.

Step 3: Label one of the jars, *Jar 1*. Place the two soaked beans between the towels and the side of the jar. The seeds should be about halfway down the jar. Slowly add water to a level just below the seeds.



Step 4: Label the other jar, *Jar 2*. Place the two unsoaked beans between the towels and the side of the jar, about halfway down the jar. Add water until the level is just below the seeds.

Step 5: Place both jars in a spot where they will be in the light and at room temperature. Leave them undisturbed for at least five days. Check both jars each day. If necessary, carefully add a small amount of water to bring it up to the starting level.

Step 6: Observe any changes that occur during these five days. Record your observations in the following chart. Draw diagrams if they will help you describe your observations. If you do not observe any changes, write *no change* in the chart.

Note: For the next five days you will need to make observations to fill in the chart. During this time you should continue to work in this section.

Observations

Day	Jar 1 (Soaked Seeds)	Jar 2 (Unsoaked Seeds)
1		
2		
3		
4		
5		

Interpretations

1. a. Do your observations support the hypothesis, or do your observations show that the hypothesis is not correct?

_____

b. Explain your answer.

_____

_____

2. This testing activity was an example of a controlled experiment. A controlled experiment is designed so that you can change only **one** variable. If all the other variables are kept the same, then you can be reasonably sure that any changes you observe may have been created by the variable you changed. For this experiment, the variable you changed was soaking the bean seeds.

a. Why was it important to test unsoaked beans as well as the soaked beans?

_____

_____

_____

b. Why was it important to place both jars in the same location?

_____

_____

_____

c. Plants usually grow in soil. What is the advantage of using paper towels to support the seeds in this experiment?

_____

_____

Discuss your answers with your learning facilitator.

Activity 6: Controlled Experiments

By making hypotheses and then testing them with controlled experiments, scientists start to understand more about the patterns they observe. A hypothesis must be testable to be of any use to a scientist. The hypothesis that you tested in Activity 5 was a very simple one, but it does show the type of questions a scientist tries to answer. A controlled experiment can give evidence that shows that the hypothesis offered a good explanation to a question. On the other hand, a controlled experiment can give evidence that does not support the hypothesis. In such cases, the hypothsis should be changed and a new controlled experiment done to test the new hypothsis.

What other variables might help a bean seed start to grow? What about light, soil, fertilizer, and sand? How could you phrase a scientific question? What would you hypothesize about each of these variables?

Remember that a hypothesis must be testable to be of use to a scientist. Try to phrase hypotheses so that your meaning is clear. Read these examples.

EXAMPLE 1: Light will not help a bean seed start to grow.
EXAMPLE 2: Placing a bean seed in a dark room will help it start to grow.

Example 2 is a better hypothesis because it indicates how to test the condition of light. In this activity you will get some practice in writing testable hypotheses.

Hypothesis

1. Write a testable hypothesis about how each of the following variables might help a bean seed to grow.

   a. VARIABLE: presence of soil

      HYPOTHESIS: _____

      _____

   b. VARIABLE: use of sand

      HYPOTHESIS: _____

      _____

c. VARIABLE: use of fertilizer

HYPOTHESIS: _____

_____

d. VARIABLE: presence of salt

HYPOTHESIS: _____

_____

e. VARIABLE: temperature of the soil

HYPOTHESIS: _____

_____

Discuss your answers with your learning facilitator.

Activity 7: Life Cycles

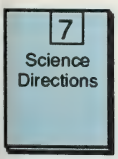
In this section you have seen that

- organisms have different growth patterns
- reproduction links one generation to the next

Life cycle: a model that shows the different stages in the development of an organism

To help understand these ideas, scientists have invented the concept of **life cycles**. The life-cycle model shows how reproduction links the adult stage of one generation to the egg, or seed, stage of the next generation.

Each type of organism (species) has its own life cycle. Read page 11 of *Science Directions 7*, and examine the illustration of the life cycle of which you are a part.



7 Science Directions

In Activity 3 you put the growth stages of a frog in the correct order. If the last stage is connected to the first stage, all of the stages then make up a life cycle. See the stages in the life cycle of the leopard frog shown near the bottom of page 20 of *Science Directions 7*.

Life cycles are easy to show if you know the stages of growth for an organism. A life cycle is usually shown as a circle – the stages are connected in order from egg (or seed) to adult.

Do either question 1 or question 2.

1. Draw the life cycle of the Colorado potato beetle. Use the diagrams on page 20 of the textbook to help you.

2. Draw the life cycle of a bean plant. Include the following stages in your model: seed, seedling, young bean plant, and mature bean plant bearing seeds. If necessary, use encyclopedias or other reference books to help you.

Check your answers with your learning facilitator.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

1. How well do you remember the meanings of words you have been reading? Read the following list of definitions, and think of a word that fits each one. Write the word in the space. If you have any difficulties, look at the word list which follows the Definitions.

   DEFINITIONS

   a. _____ a living thing

   b. _____ a model that describes the pattern of growth and the process of reproduction of an organism

   c. _____ identifying features

   d. _____ a group of living things in which all organisms are similar in size and shape

   e. _____ what an experimenter changes when conducting a controlled experiment

   f. _____ a statement that explains why something happens

   g. _____ the last stage of growth of an organism

   h. _____ used to show a pattern for a set of observations

   i. _____ a stage, following the egg stage, in the life cycle of the Colorado potato beetle

   j. _____ what links the adult stage of one generation to the egg, or seed, stage of the next generation

Choose the word from the following list that best matches each definition. Write the word in the blank space. If you have trouble matching the word with the definitions, look back through this section to see how the word was used.

WORD LIST

adult	graph	larva	organism	species
characteristics	hypothesis	life cycle	reproduction	variable

2. Kathryn wanted to find out more about how plants grow. Here are the things she did. They are out of order. Arrange the actions in the correct order by writing a number (1 to 6) in the space by each action.

_____ She collected all the things she needed for the experiment.

_____ She wrote a report about what she had learned from her observations.

_____ She wrote a hypothesis on variables that might affect plant growth.

_____ She recorded all her observations in a chart.

_____ She carefully observed radishes growing under different conditions.

_____ She listed several variables that might affect plant growth.

Check your answers with your learning facilitator.

Enrichment

Suppose that you have been given a new puppy. It has large feet, small ears, and a short body. You are trying to decide if the puppy will grow into a large dog.

1. Write a hypothesis about your idea. Remember that your hypothesis should be testable and it should be based on the information that you are given.

_____

_____

_____

2. You plan to test your hypothesis by recording the puppy's growth over a period of one year. What measurements should you make each month?

_____

_____

_____

_____

_____

3. You want to organize the measurements you plan to make. Design a chart to do this.

Check your answers with your learning facilitator.

Conclusion

You now should have a better understanding about growth patterns and why growth is a characteristic of all living things.

You should also know that life-cycle models have been developed to compare the growth stages of different species.

Even though every species has its own life cycle, all organisms grow and reproduce. Growing and reproducing helps a species survive. In the next section you will learn about other things that help organisms survive.

Assignment Booklet

ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 2.

Section

3

Variety of Life

You have seen the differences between humans, dogs, cats, and other organisms around you in your daily activities. No organism, not even one of the same type, is exactly like another. There is a great deal of variation in living things. This section will help you understand variation.

In this section you will look at the similarities and differences between groups of living things and recognize that there is variation within a species. You will then get practice in identifying the characteristics of several different groups.

Activity 1: Understanding Variation in Living Things

The previous drawings show that a species, such as the dog, can be quite varied. Even though dogs share common characteristics, they can vary in their overall size, shape, and colouration.

A different species of organism is the Canada goose. If you saw a flock of geese flying overhead you would notice that all the birds had the same shape, the same colours, and were flapping their wings at the same rate. The flock would appear to be made up of identical birds. However if you could get very close to the geese, you would notice many differences; some would be bigger than others, some would have differences in colour, and some would sound different. These differences are called **variations**.

Variation: differences among individual members of a species, such as differences in size, shape, colour, or behaviour

You will now consider an example of variation that involves four different species of insects that fly. Different species of insects fly at different rates, whereas some insects do not fly at all.

Most of you are familiar with the following four insects: dragonfly, honeybee, housefly, and butterfly.

1. a. Which of these four insects do you think will fly the fastest?

   _____

   b. Why did you choose this insect?

   _____

   _____

2. a. Which of the four insects do you think will fly the slowest?

   _____

   b. Why did you choose this insect?

   _____

   _____

Prediction: an opinion about what might happen on the basis of previous observation and experience

Scientists look for patterns, and then they try to explain why these patterns exist. You guessed which insect was the fastest and which was the slowest. Perhaps you can do better than guessing. With more information you can make a **prediction**. A prediction is like a guess, but it is based on information and is more likely to be correct than a guess is. Here is some additional information about each of the insects.

Insect	What the Insect Eats
dragonfly	other insects
honeybee	nectar from flowers
housefly	almost any food
butterfly	nectar from flowers

Now that you know what each insect eats, think about which insect needs to fly fast to get food.

3. a. Predict which insect flies the fastest.

_____

b. Give a reason for your prediction.

_____

_____

4. a. Predict which insect might fly the slowest.

_____

b. Give a reason for your prediction.

_____

_____

Now refer to page 35 of the textbook, *Science Directions 7*, for even more information. Examine the chart to find out the flight speeds of each of the four insects.

5. How accurate were your predictions for questions 3 and 4? Explain.

_____

_____

Discuss your answers with your learning facilitator.

Activity 2: Variation Within a Species

Your predictions comparing the speeds of flying insects were likely better than your original guesses. The more observations you make, the more likely it is that you will be able to find patterns and start to develop explanations about the patterns. In this section you will primarily look for variation. In Sections 4 and 5 you will learn about scientific explanations for a great variety of living things.

In Activity 1 you looked at four different species. Now you will look at organisms within the same species. The introduction used the dog species as an example. You also considered geese. But what about the human species? A quick look around you confirms that people show great variation. Your height, weight, hand size, and lung capacity are probably different from everyone around you.

Do you know how much variation there is among people? In this activity you will measure one aspect of this variation. The two questions you will be investigating are these:

- How much air can you move in and out of your lungs in a single breath?
- How much variation in lung capacity is there among different people?

7 Science Directions

Read Getting the Gases In and Out on page 31 of the textbook, *Science Directions 7*, to get some background information. Then follow the instructions given to complete this activity.

Note:

- The instructions which follow are similar to those on page 31 of the textbook under Checking Your Lung Capacity except that you will need to involve three other people, in addition to yourself. The instructions under Steps to Follow will allow you to do so.

- See your learning facilitator about getting the materials needed to complete this activity.

Materials You Need

- water
- 500 mL measuring cup
- plastic bucket
- waterproof marking pen
- five identical balloons or freezer bags

Steps to Follow

Step 1: Fill a plastic bucket half-full of water. Using a waterproof marking pen, mark a line on the bucket at the top of the water. Label this line 0 mL. (See the diagram on page 31 of *Science Directions 7*.)

Step 2: Pour 500 mL of water into the bucket. Use the marking pen to indicate the change in water level. Label this 500 mL. Add another 500 mL of water. Use the same process to mark lines at 1000 mL, 1500 mL, 2000 mL, and so on, until the bucket is nearly full.

Step 3: Carefully pour out the extra water you added until the water level in the bucket is again at the level you marked as 0 mL.

Step 4: Select one of the balloons or freezer bags. Breathe in as deeply as you can. Breathe out as much air as you can into the balloon or freezer bag. Just exhale once, since you are measuring how much air you can move in and out of your lungs in a single breath.

Step 5: Quickly seal the open end of the balloon or freezer bag, keeping it closed with your finger or a piece of string.

Step 6: Once the air is securely trapped inside the balloon or freezer bag, submerge it in the bucket of water. Try not to put your hand in the water.

Step 7: In the observation chart record the water level.

Caution

Dispose of the balloon or freezer bag after using it. Do not let anyone else use it.

Step 8: Repeat steps 4 to 7 with three other people. Remember to use a different balloon or freezer bag for each person to prevent the spread of germs.

Observations

Name of Person	Volume of Air Moved (mL)

Interpretations

1. How much air can you move in and out of your lungs in a single breath?

   _____

2. How much variation was there among the four people you measured? (Subtract the smallest measurement from the largest measurement.)

   _____

3. Think about who had the largest lung capacity and who had the smallest lung capacity. Can you think of a possible reason for this? Briefly describe your reason.

   _____

   _____

   _____

4. To test your explanation, you can make a prediction. Based on your explanation, choose a person you think should have a large lung capacity, and using the same method you used before, measure that person's lung capacity. (Remember to use a new balloon or freezer bag.)

   a. Name of Person: _____

   b. Predicted Lung Capacity: _____

   c. Measured Lung Capacity: _____

Note: If you are in a situation where you are unable to measure the actual lung capacity of the person you selected, proceed to question 5.

5. If your prediction is not close to what you measured, your reasoning may be incorrect. If your prediction is correct, your reason might be correct. However, one prediction and one test is not very much evidence. What could you do to have more confidence in an explanation that seemed correct?

_____

_____

_____

Check your answers with your learning facilitator.

Activity 3: Classifying Organisms

People are often curious about the incredible variation that is exhibited by organisms. Were you curious about the differences in lung capacity of the people you measured?

lassification: the placement of ings that are alike in some way to groups

Curiosity motivates scientists to learn more about the variation of organisms. To study variation, scientists find it useful to divide organisms into groups. This is called **classification**. Deciding which organisms belong in a group requires a list of characteristics for members of a group. Once organisms are classified, patterns can be identified to help scientists explain why organisms show so much variation.

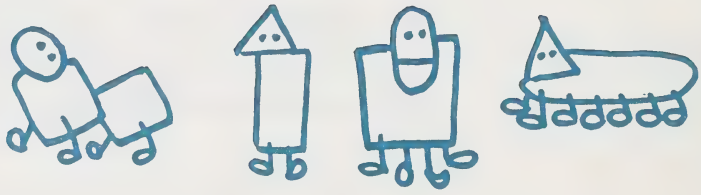
This activity will help you develop skills in identifying the characteristics of groups. You are going to examine some simple diagrams. Some of these belong to an imaginary group called Doles.

1. Try to figure out what characteristics all the Doles have that others do not have.

   All of these are Doles.

   None of these is a Dole.

   a. Which of the following figures are Doles? Circle them.



   b. What characteristic is used to identify Doles?

   _____

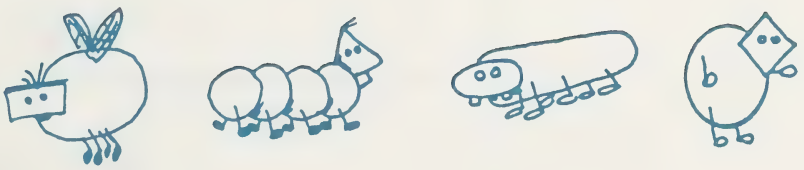
   _____

   _____

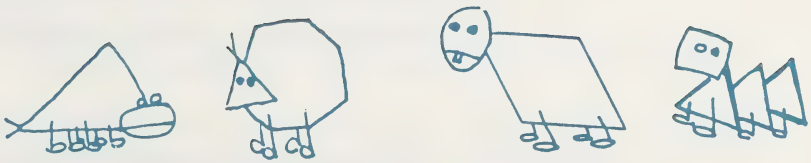
c. Draw two more Doles.

2. Now try to figure out what characteristics all the Gleeps have that others do not have.

All of these are Gleeps.



None of these is a Gleep.



a. Which of the following figures are Gleeps? Circle them.

b. What characteristic is used to identify Gleeps?

_____

_____

c. Draw two more Gleeps.

By doing a fun activity involving imaginary creatures, you have practised the skill of identifying similarities and differences. Using imaginary creatures allow simpler classifying. Real organisms are much more complex. Often the criterio for a group cannot be determined by just observing the physical appearance of a organism.

Check your answers with your learning facilitator.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help 1: How Wide Is Your Handspan?

This activity will help you learn more about variation. You will examine your handspan and the handspan of other people.

Questions for Investigation

The questions for this activity are

- How much variation is there in the handspans of different people?
- Can you predict who will have the largest handspans?

Materials You Need

- ruler
- pencil
- sheet of paper (graph paper or plain paper)

Steps to Follow

Step 1: Spread out your hand on a piece of paper. Mark a point at the tip of your thumb and your little finger. Note: Do not include the length of your fingernails. (See the illustration on page 13 of your textbook, *Science Directions 7*, to help you understand how to do this.)

Step 2: Join the two points, and measure the line length in millimetres. This length is your handspan.

Step 3: Record your handspan and the handspan of other people in the chart that follows. To do this, place a mark (or tally) for each measurement taken. When you have tested as many people as you can, record the number of handspans in each group.

Try to find at least fifteen people to test.

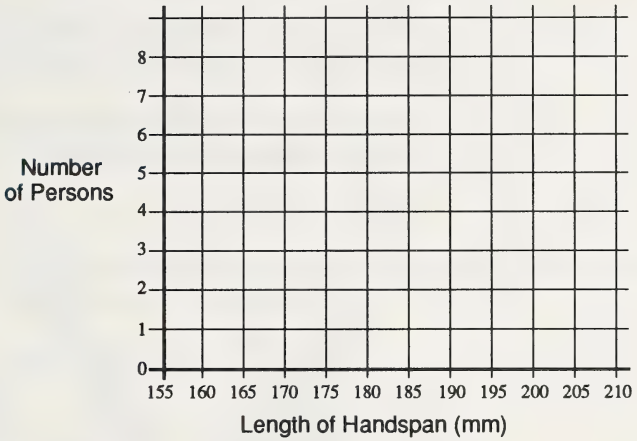
Observations

Handspan in Millimetres (mm)	Tally	Number of Persons
155 - 159		
160 - 164		
165 - 169		
170 - 174		
175 - 179		
180 - 184		
185 - 189		
190 - 194		
195 - 199		
200 - 204		
205 - 210		

Often data in charts is easier to understand if it is presented in the form of a diagram called a graph.

Optional: Using the graph paper provided, make a bar graph that shows the data you have collected on handspans. (If you need help on how to construct bar graphs, see Skillbuilder Four on pages 361 to 363 of your textbook, *Science Directions 7*.)

Variations in People's Handspans



Interpretations

1. Which group of handspan sizes did you find most often?

   _____

2. For most human beings, handspan size is probably not important.

   a. Suggest a way of life that would make having small hands an advantage.

   _____

   _____

   b. Suggest a way of life that would make having large hands an advantage.

   _____

   _____

3. Can you predict the size of a person's handspan? If so, what clues do you use in predicting the span?

   _____

   _____

Check your answers with your learning facilitator.

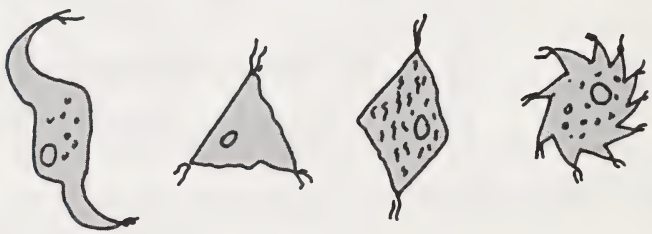
Extra Help 2: Classifying Shapes

In this activity you will look at more diagrams of imaginary creatures and then put them in groups. This time the creatures are Woozles and Klaks.

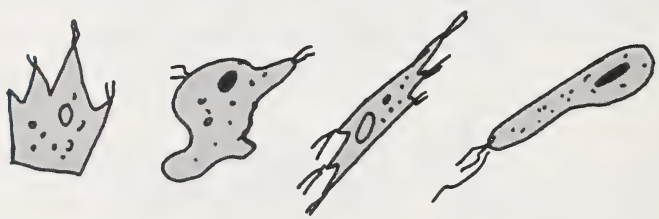
1. Woozles have at least one characteristic that other creatures do not have. Try to figure out what this characteristic is.

   All of these are Woozles.

   None of these is a Woozle.



   a. Which of the following figures are Woozles? Circle them.



   b. What characteristic is used to identify Woozles?

   _____

   _____

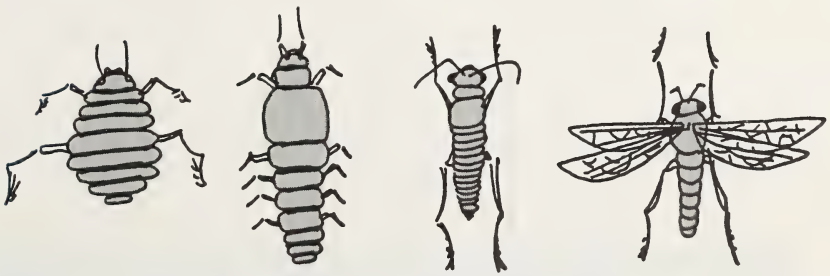
c. Draw two more Woozles.

2. Klaks have at least one characteristic that other creatures do not have. Try to figure out what the characteristic is.

All of these are Klaks.

None of these is a Klak.

a. Which of the following figures are Klaks? Circle them.



b. What characteristics are used to identify Klaks?

_____

_____

c. Draw two more Klaks.

Check your answers with your learning facilitator.

Enrichment 1: Describing Diversity

In this activity you will examine some drawings of actual plants and identify some characteristics that are different between the two plants shown.

Wormseed Mustard

Chamomile

Examine the drawings of the two plants. See if you can identify four ways in which the two plants are different.

- _____
  _____
- _____
  _____
- _____
  _____
- _____
  _____

Check your answers with your learning facilitator.

Enrichment 2: Classifying Carefully

In this activity you will examine some diagrams of actual living things and put them into groups. You will then have the opportunity to invent some imaginary plant or animal groups just like the ones you worked with earlier in this section.

1. The first group you will learn about are plants that belong to an actual plant group known as the Mustard family. Try to figure out what characteristics are useful in identifying members of this family.

   All of these are members of the Mustard family.

   None of these is a member of the Mustard family.

a. Which of the following are members of the Mustard family? Circle them.

b. What characteristics are useful to identify members of the Mustard family?

_____

_____

c. Draw an imaginary member of the Mustard family that fits the characteristics you have found.

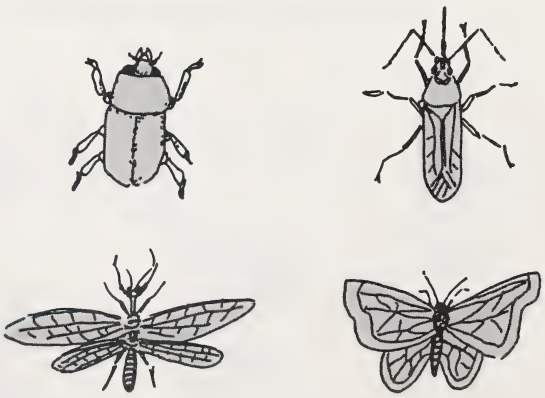
d. If you are interested in learning more about plants in the Mustard family, you could look for some examples in a weedy area of your community. Many common weeds are members of this family.

   If you find some weeds that you think are members of the Mustard family, collect them and compare them with the pictures. The upper part of the plant should look similar to at least some of the pictures.

2. The second group you will learn about is a collection of insects that belong to a group known as the Diptera. Try to figure out what characteristics are useful to identify Diptera.

   All of these are Diptera.

   None of these is a member of the Diptera family.



a. Which of the following are Diptera? Circle them.

b. What characteristics are useful to identify Diptera?

_____

_____

c. Draw an imaginary member of the Diptera group.

3. Special Challenge!

See if you can invent an imaginary group of living things and make up an activity like the ones you have just done. To do this, you will need to think about what your new plant or animal would look like. Give your group a name.

The name of my new plant or animal is _____.

Now use this name in each of the following.

a. All of these are _____ . (Fill in the name, and then draw four variations on the idea you have.)

b. None of these are _____ . (Make four drawings that do not fit the rule or characteristic.)

c. Which of the following are _____? Circle them. (Draw at least one that fits the characteristic and others that do not.)

d. How can you recognize a member of your group? Describe the characteristic that you used to identify it.

_____

_____

_____

4. Extra Special Challenge! (This part is optional.)

If you would like to try one further challenge on your own, you can do another grouping activity like you just did. This time use actual plants instead of drawings. To do this, you will need to collect a group of plants from your local area. Then find a characteristic that fits only some of the plants. On your own piece of paper or cardboard, write out your plan and tape on the plants (or parts of the plants) instead of using pictures.

You will probably want to collect only parts of the plant and only plants that are common wild plants. (Be sure not to collect anything that is rare or uncommon. If in doubt, do not collect the plant.)

You may want to involve your friends and family in this challenge.

Check your answers with your learning facilitator.

Conclusion

In this section you have looked at the variation of organisms within the same species and within different species. You made predictions based on what you thought would help organisms survive. You practised classifying and you identified the characteristics that were used to help you classify.

Classification helps bring attention to important features of the materials studied. Classifying is an important skill in science. In the following sections you will learn more about the variety of different organisms that are found on the earth. You should also start to understand how scientists explain the variety.

Assignment Booklet

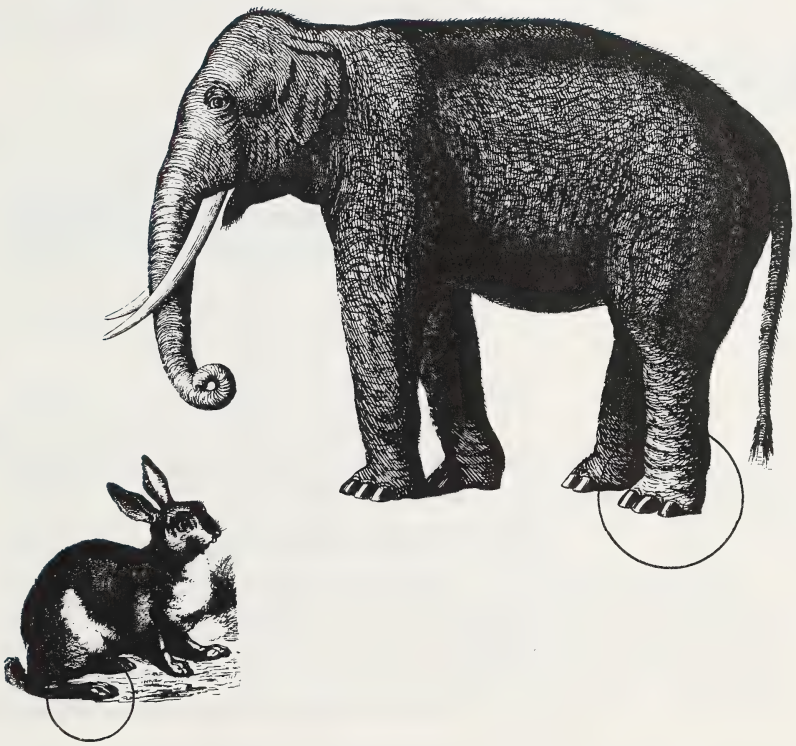
ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 3.

Section

4

Structural Adaptations



In Section 3 you learned about variation among species and within a species. In this section you will start to develop explanations for these and other variations.

Why is the shape of a rabbit's leg so different from the shape of an elephant's leg? Why do birds have such a wide variety of beaks? Why does a cactus look so different from an elm tree? Questions that start with the word *why* require answers that give reasons or explanations.

After you have finished this section you should be able to describe animal and plant adaptations and be able to explain the value of adaptations.

Activity 1: Making Inferences

Rabbits run faster than most forest animals. Squirrels climb trees better and faster than most forest animals. Cougars have sharp claws, and porcupines have sharp, pointed quills. Why are these animals so different?

This activity will give you practice in explaining why different species of organisms look so different from each other. Explaining observations is called **inferring**.

Inferring: interpreting observations; deciding what the observations mean

When you observe, you use your five senses to gather information. Sometimes you use instruments to measure things. The information that you obtain is your observations. When you explain observations, you are inferring. When you infer the result is an **inference**.

Inferences: possible explanations for something observed

You often make inferences without even realizing it. For example, when you hear a noise in a hallway you often infer that someone is walking down the hall. Because of your experience with these noises, you are able to explain the sound based on very limited observations.

For each observation, infer (explain) how the feature observed helps the organism survive. Then describe other observations about the organism that support your inference.

1. OBSERVATION: Rabbits run quickly when alarmed.

   INFERENCE: _____

   _____

   Describe other observations about rabbits that support your inference.

   _____

   _____

2. OBSERVATION: Porcupines have quills.

   INFERENCE: _____

   _____

   Describe other observations about porcupines that support your inference.

   _____

   _____

3. OBSERVATION: Ducks have webbed feet.

   INFERENCE: _____

   _____

   Describe other observations about ducks that support your inference.

   _____

   _____

Check your answers with your learning facilitator.

Activity 2: Adaptations in Animals

Activity 1 described three animals that have structures which help them survive. Rabbits have legs designed to help them run fast. Porcupines have sharp quills for protection. Ducks have webbed feet for swimming.

To help explain why animals and plants have such a variety of structures, scientists infer that the structures help the organisms survive. This idea that the structure of an organism helps it survive is called **structural adaptation**. The inferences that you made in Activity 1 are examples of the idea of structural adaptation.

Structural adaptation: a special body part that helps an organism survive in its surroundings

Structural adaptation is helpful in understanding why organisms have so many different types of structures. The rest of this section will help you use this idea.

Organisms are adapted in many different ways to use the various food sources on earth. For information on some structures that insects use for getting food, read page 28 of the textbook, *Science Directions 7*, and examine the diagrams of the insect mouthparts that are shown. Notice that insect mouthparts are really quite different. There are mouths for sawing, sponging, piercing, and sipping. By using the idea of structural adaptation, you can explain that the different types of mouths are adapted for eating different types of food. Each adaptation is effective for the insect that uses it.

Insects are not the only organisms that have specialized mouthparts that allow them to eat certain kinds of food. Next you will find out what structural adaptations some birds have to help them get their food.

7 Science Directions

7 Science Directions

1. Look at the diagrams of the birds shown on page 29 of *Science Directions 7*. Pay particular attention to each beak. Then read the description about the birds (a to l) that follows. In the blank space write the name of the bird that best fits each description.

   a. I fly low along open water, with my bill slightly open, and my lower bill in the water so I can skim small organisms right off the surface.

   _____

   b. I use my strong jaw muscles and strange-looking bill to pry apart the scales on pine cones so I can get at the seeds inside the cones.

   _____

   c. I breed in prairie sloughs. You'll see me there feeding as well. I wade in shallow water, swinging my bill back and forth in the water to gather tiny organisms swimming in the water.

   _____

   d. I have a straining device in my mouth. I take in water that contains tiny organisms, filter out the water, and leave the organisms inside my mouth. I tend to turn my head upside down to eat. By the way, I have a long neck and legs, and I'm pink.

   _____

   e. You'd confuse me with a bee if you couldn't clearly see that I'm a bird. That's because I often eat the same food as bees – nectar from flowers. I also eat insects, although not very many people know that.

   _____

   f. I fly along ready to open my mouth wide as soon as I see an insect – an efficient way of catching insects in flight. Bristles around my beak help funnel the flying insects into my gaping beak.

   _____

   g. I'm a diving duck; I have teeth-like structures on my beak to keep the fish I'm attacking from slipping away.

   _____

   h. I'm a wading duck. I don't bother to dive. I just dip from time to time to eat floating vegetation. I often hang around ponds in city parks.

   _____

i. My beak serves the same purpose as a dog's canine teeth. I can rip and shred meat with it. Because I eat meat, I attack other organisms. I am called a predator.

_____

j. I peck on trees to get to the beetle larvae, ants, and termites that live in wood.

_____

k. I am a close relative of the bird described in *j*. Personally, I prefer sap from trees and the insects that come to drink the sap.

_____

l. I feed along the shores of ponds and lakes and in prairie sloughs. I'm a large wading bird and have long legs so I can easily wade in water. To get food I stand silently, then suddenly stab at frogs and small fish with my sharp pointed bill.

_____

Check your answers with your learning facilitator.

Activity 3: Adaptations in Plants

You have read some examples of animals that have adapted in many ways. Survival is also important for plants. Plant adaptations enable some plants to live where others cannot.

A cactus is an excellent example of a plant that is adapted to a dry, hot climate.

- A cactus has very thick skin to prevent water loss.
- A cactus has shrunken leaves, that look like spines, to prevent water loss.
- A cactus has very shallow roots that enables it to collect water when it rains.

Other plants have different structural adaptations. For some plants, the way they look in their surroundings is very important to their survival. Read page 62 of *Science Directions 7* to find out how an attractive appearance helps plants such as the rose and the foxglove's flower to survive.

7 Science Directions

Do either Part A, Part B, or Part C.

Part A involves drawing a diagram and writing descriptive notes.

Part B involves making a model and writing descriptive notes.

Part C involves explaining existing diagrams.

Part A: Plant Diagram and Interpretations

Note: You do not need to complete Part A if you wish to do Part B or Part C.

Invent an imaginary plant that is adapted to survive a special condition. You can choose this condition from the following list. Draw a diagram of your imaginary plant, and then describe how you can infer that the plant is adapted to survive the condition indicated.

Invent one of the following plants. Write an *X* in the space in front of your choice.

_____ a plant that can survive being run over by a lawn mower
_____ a plant that can catch insects
_____ a plant that can store water during dry periods
_____ a plant that grazing cattle will not eat
_____ a plant that can withstand high winds
_____ a plant that can live on the surface of ponds or sloughs

Diagram of Your Plant

Interpretations

Explain how your imaginary plant is adapted to the condition you have chosen. Describe features of the plant that help it survive.

_____

_____

_____

_____

Discuss your answers with your learning facilitator.

Part B: Plant Model and Interpretations

Note: You do not need to complete Part B if you have already done Part A or wish to do Part C.

Invent an imaginary plant that is adapted to survive a special condition. You can choose this condition from the following list. Make a model of your imaginary plant, then describe how you can infer that the plant is adapted to survive the condition indicated.

Invent one of the following plants. Write an *X* in the space in front of your choice.

_____ a plant that can survive being run over by a lawn mower
_____ a plant that can catch insects
_____ a plant that can store water during dry periods
_____ a plant that grazing cattle will not eat
_____ a plant that can withstand high winds
_____ a plant that can live on the surface of ponds or sloughs

Model of Your Plant

Make a model of your imaginary plant. Use anything you want to help show your plant's structural adaptations. For example, you could use cellophane, modelling clay, coloured paper, wire, or ribbon.

Interpretations

Explain how your imaginary plant is adapted to the condition you have chosen. Describe features of the plant that help it survive.

_____

_____

_____

_____

_____

Discuss your answers with your learning facilitator.

Part C: Explaining Existing Plant Diagrams

Note: You do not need to complete Part C if you have already done Part A or Part B.

Four grade 7 students drew diagrams of imaginary plants that were adapted to survive some special conditions. Examine each diagram, then infer which condition the plant could survive. Write the number of the condition in the space provided for each plant, then describe why you inferred that it was adapted to survive the condition you chose.

Conditions:

1. a plant that can survive being run over by a lawn mower
2. a plant that can catch insects
3. a plant that can store water during dry periods
4. a plant that grazing cattle will not eat
5. a plant that can withstand high winds
6. a plant that can live on the surface of ponds or sloughs

Gurpreet's Diagram

Which condition do you think Gurpreet's plant can survive? _____

Explain how Gurpreet's imaginary plant is adapted to the condition you have chosen.

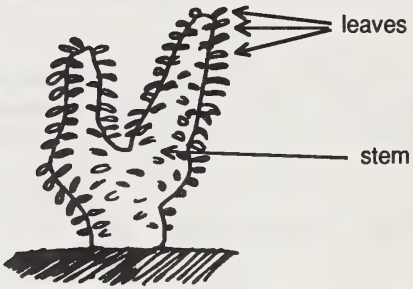
_____

_____

_____

Jennifer's Diagram

Which condition do you think Jennifer's plant can survive? _____



Explain how Jennifer's imaginary plant is adapted to the condition you have chosen.

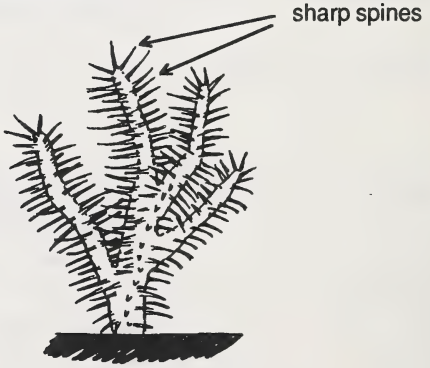
_____

_____

_____

Marcel's Diagram

Which condition do you think Marcel's plant can survive? _____



Explain how Marcel's imaginary plant is adapted to the condition you have chosen.

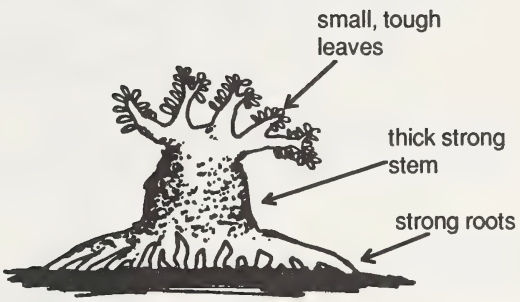
_____

_____

_____

Huynh's Diagram

Which condition do you think Huynh's plant can survive? _____



Explain how Huynh's imaginary plant is adapted to the condition you have chosen.

_____

_____

_____

Discuss your answers with your learning facilitator.

Activity 4: Camouflage

Camouflage: the ability of an organism to hide in its environment and look almost invisible

The colour and shape of some organisms helps them hide from predators or prey. This kind of structural adaptation is called **camouflage**. Turn to pages 62 and 63 of *Science Directions 7* to find out how camouflage helps the following four organisms to survive – walking stick insect, larva of a tiger swallowtail butterfly, tiger, and sargassum fish.

7 Science Directions

After reading about these four organisms, you should be able to think of other examples of organisms that are adapted to their environment by camouflage.

Do either Part A or Part B.

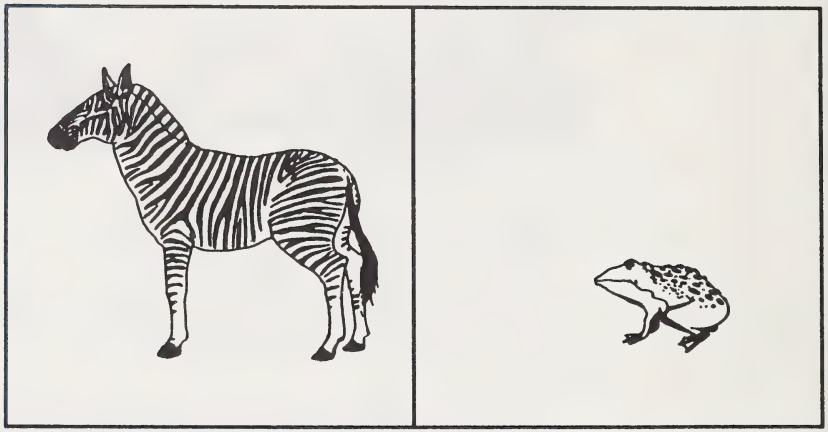
Part A involves drawing and colouring a picture.

Part B involves camouflaging an imaginary animal and then hiding it in a selected environment.

Part A

Note: You do not need to complete Part A if you wish to do Part B.

Draw an environment for the following two animals. Then colour each picture. Try to show how each animal is adapted to its environment by camouflage.



Discuss your answers with your learning facilitator.

Part B

Note: You do not need to complete Part B if you have already done Part A.

Materials You Need

- potato
- paint
- toothpicks
- modelling clay
- glue
- white latex paint
- brush
- tongue depressor
- cotton wool
- tape

Steps to Follow

Step 1: Pick a location in which to hide an imaginary animal. Some possible locations are a lawn, a wooded area, a gravel path, and a flower bed.

Step 2: Use a potato as the animal you will camouflage in your chosen location.

Step 3: Paint the potato white. The main body part of your imaginary animal must remain white. Your challenge is to add things to this white animal so that it can hide in the location you have chosen.

Step 4: Camouflage the potato animal using either items from the material list or any other material you wish to add. Remember that you cannot paint the potato any other colour than white.

Step 5: Once your potato animal is camouflaged, place it in the location you have chosen. Place a second potato that has been painted white, but not camouflaged, near your camouflaged potato.

Step 6: Ask someone to hunt for your potato animal. Time how long it takes them to find the potato.

Interpretations

1. Was your animal easily found? Why or why not?

_____

_____

_____

2. How might you improve your camouflage?

_____

_____

_____

_____

_____

Discuss your answers with your learning facilitator.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

In this section you studied a variety of structures that help plants and animals survive. To get a better understanding of why different species of organisms show so much variation in structure, you will look at some of the structural adaptations of one more organism. You will look at how fish are adapted to move in water.

If you have access to an aquarium, carefully watch how a fish moves. If you cannot observe a fish moving, refer to pages 39 and 40 of *Science Directions 7* and other available reference books to find out how a fish moves.

7 Science Directions

Describe three features of a fish that help it move through the water. Write each answer in a sentence.

- _____
  _____
- _____
  _____
- _____
  _____

Check your answers with your learning facilitator.

Enrichment

Most land plants cannot survive in salt water, yet the seeds, or nuts, of the palm tree are among the best sailors. Because of their hard outer shells, they can float in sea water for years and still sprout and grow when they wash ashore on an island. Scientists use the idea of structural adaptation to explain how these seeds help the survival of palm trees. By spreading themselves to new islands, which they reach by floating on sea water, the palm trees continue to exist.

Seeds from different plants have a variety of structures that enable them to be scattered in many ways.

7 Science Directions

Read pages 22 and 23 of *Science Directions 7*. Look at the diagrams of seeds of some common plants shown on page 23.

Think about how these seeds might move from one place to another. Then choose one of the seeds and examine it closely. Based on your observations, write an inference about how you think the seed might move. Write one observation about the seed that supports your inference. Do this for four different seeds.

- Seed Chosen: _____

  Inference: _____

  _____

  Supporting Observation: _____

  _____

- Seed Chosen: _____

  Inference: _____

  _____

  Supporting Observation: _____

  _____

- Seed Chosen: _____

  Inference: _____

  _____

  Supporting Observation: _____

  _____

- Seed Chosen: _____

  Inference: _____

  _____

  Supporting Observation: _____

  _____

Check your answers with your learning facilitator.

Conclusion

In this section you made inferences about why different species of organisms show so much variation in structure. Your inferences are explanations for the variations you observed. If you find other observations to support your inference, you will feel more confident that your explanation is a good one.

Plants and animals do not decide to adapt, just as you did not decide how tall to be or what colour of hair you should have. Adaptation is an idea, not an action. Scientists use the idea of adaptation to explain variation. Using the idea of adaptation will help you understand the complexity of the natural world. In the next section you will look at a different kind of adaptation.

Assignment Booklet

ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 4.

Section

5

Behavioural Adaptations

In the last section you learned that a porcupine's quills, a turtle's shell, and a rabbit's legs are structures that help the animals survive. Scientists explain these variations in appearance by using the idea of structural adaptation.

Organisms also behave in a wide variety of ways. This section will introduce you to the idea of behavioural adaptation. Why do some birds fly south during the winter? What do the other birds do?

By the end of this section you should be able to explain why some animals behave differently than others. You will also learn about two behavioural adaptations that are common in an environment with cold winters – migration and hibernation.

Activity 1: Overcoming Cold Climates

You have probably observed geese flying south in the fall. Most people think that geese and other birds fly south to avoid the cold of winter. If this explanation is correct, why don't all birds fly south? And why don't the birds stay where it is warm all year?

Behaviour: the way an organism acts under certain conditions

Observing that birds fly south every fall is only one observation of the birds' **behaviour**. Explanations based on only a few observations often don't explain other behaviours. The next activity will ask you to think of other explanations. You will be shown more observations later, but try to make several hypotheses from what you already know about birds. Think about the birds that do not fly south.

1. Name three species of birds that fly south for the winter.

   _____

   _____

   _____

2. Give two hypotheses about why you think they fly south. Each hypothesis should be stated in a sentence.

   - _____

     _____

     _____

   - _____

     _____

     _____

Check your answers with your learning facilitator.

Activity 2: Migration

Behavioural adaptation: a change in the way an organism reacts towards a change in its environment

Migration: the temporary movement of organisms from one area to another, then returning back to the original area

7 Science Directions

An organism changes its behaviour when the environment changes. Changing its behaviour helps an organism survive. This is called **behavioural adaptation**. Geese flying south for the winter is an example of behavioural adaptation.

When winter comes, organisms either stay in the environment or leave the environment. Leaving the environment and then returning later is called **migration**.

Read page 58 and the top of page 59 of *Science Directions 7*. Study Table 8 regarding foods that small birds eat.

You now have additional information on why some birds migrate while others do not. The additional information about what birds eat leads to a better inference. Birds may migrate because colder temperatures may eliminate their food supply. As food becomes scarce, the birds fly south searching for food and a warmer climate. More observations lead to better inferences.

You have learned that some animals migrate in search of food supply and warmer temperatures. Biologists think other animals migrate for other reasons. Return to page 59 of your text to find out why earthworms migrate (move down their burrows deep into the soil). On the same page also read about the migration patterns of the blue whale.

Imagine that you are a biologist studying the behaviour of animals during the winter. Describe what could happen to the following animals if they did not migrate for the winter. Remember that migration is explained as a behavioural adaptation which helps the organism survive.

Blue Whale: _____

_____

_____

_____

Yellow-rumped Warbler: _____

_____

_____

_____

Discuss your answers with your learning facilitator.

Activity 3: Hibernation

How do organisms survive winter if they do not migrate? You learned about the chickadee and nuthatch fluffing up their feathers for insulation and keeping active to generate heat. Some organisms behave in a very different way.

Hibernation: a period of seasonal activity in which an animal passes the winter in a resting state

Some organisms go into a deep sleep called **hibernation** in response to winter's changes. When an organism hibernates, all its body processes slow down. As a result, the organism uses very little energy. It needs no food since its body's fat supplies it with all the energy it needs.

7 Science Directions

Turn to page 66 of *Science Directions 7*. Read the information that is given about hibernating squirrels, and study the graphs on the heart rate and body temperature of the thirteen-lined ground squirrel.

1. Why do you think John made the predictions that he did?

_____

_____

_____

2. Use the graph to find the following information. What is the

   a. heart rate of an active squirrel? _____

   b. heart rate of a hibernating squirrel? _____

   c. body temperature of an active squirrel? _____

   d. body temperature of a hibernating squirrel? _____

3. How does the graph support his two predictions?

_____

_____

_____

_____

Check your answers with your learning facilitator.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

7 Science Directions

The cartoons on page 67 of the textbook, *Science Directions 7*, present some interesting behavioural adaptations. Read the cartoons and the captions. Answer the following questions.

1. Describe a human behaviour that helps keep body temperature at 37°C when the outside temperature is cold.

_____

_____

_____

2. Describe a human behaviour that helps keep body temperature at 37°C when the outside temperature is hot.

_____

_____

_____

Check your answers with your learning facilitator.

Enrichment

Birds and mammals are warm-blooded. Warm-blooded animals have internal receptors that control their body temperature, keeping it within a fairly narrow range. Your body temperature, for example, is usually fairly close to 37°C. If your temperature rises above that level, it usually means that you're not well.

All other animals are cold-blooded. Cold-blooded animals have no internal receptors to control their temperature. They simply take on the temperature of their environment.

Being warm-blooded does have some advantages, but a warm-blooded animal has to eat ten times as much food in a year as a cold-blooded animal of the same size.

Think of some cold-blooded animals. Choose two and then describe behavioural adaptations of each that helps them survive very cold or very hot weather.

1. Name of Animal: _____

   Behavioural Adaptation: _____

   _____

2. Name of Animal: _____

   Behavioural Adaptation: _____

   _____

If you had difficulty with the previous questions, refer to pages 64 and 65 of *Science Directions 7* for additional information.

7 Science Directions

Check your answers with your learning facilitator.

Conclusion

Behavioural adaptation is an idea that explains why organisms change their behaviour so that they can survive changes in their environment.

Two very noticeable behavioural adaptations in an environment with cold winters are migration and hibernation.

Assignment Booklet

ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 5.

Section

6

Stimulus and Response

If a dog approaches a bird sitting on its nest, the bird will fly away. To survive, organisms must react to changes. In this section you will use a scientific model to help explain and predict how organisms will react to changes in their environment.

When you have finished this section you should be able to identify stimulus-response patterns in the behaviour of organisms. You should also be able to distinguish between learned, instinctive, and involuntary responses.

Activity 1: Understanding Stimulus and Response

For an introduction to this topic, read page 46 of the textbook, *Science Directions 7*.

Stimulus: a change that causes a reaction

A change in the environment is called a **stimulus**. The plural of stimulus is stimuli. The stimuli in the cartoons on page 46 are

- cold air at the bus stop
- a bird on the ground

Response: a reaction to some change in the environment

A reaction to a stimulus is called a **response**. The responses in the cartoons were

- the boy shivering
- the cat preparing to jump

To understand how animals survive a wide range of changing situations, you can use a stimulus-response model. You can link (connect) a stimulus with a response and predict the likely outcome. Here is an example.

> Observing whales would show you that whales swim in the Arctic Ocean during the summer. Whales must reach the surface to breathe, because they cannot breathe under water. When winter comes, the water starts to freeze and forms an ice pack. The ice pack completely covers the water, preventing the whales from reaching the surface.

To build a stimulus-response model, you must first identify its parts.

STIMULUS: freezing water

Possible RESPONSES:

- whales swim south to warmer water

or

- whales stay in ice-covered water

Possible RESULTS:

- whales survive

or

- whales die (because they cannot breathe under water)

To complete the model, you now need to link the stimulus with a response and a likely result.

Here are two possible linkages.

• STIMULUS (freezing water)	→	RESPONSE (whales stay in ice-covered water)	→	RESULT (whales die since they cannot reach the air)

• STIMULUS (freezing water)	→	RESPONSE (whales swim south to warm water)	→	RESULT (whales live since the warm water is not covered by ice)

These two linkages show that the whales that swim south to warmer water have a much better chance of surviving.

Model: a diagram or description that helps make sense out of a collection of related observations

This is only a **model**. The use of a model helps us to understand, explain, and predict. This model helps us explain that whales that migrate in the winter have a better chance of surviving. But the model does not tell us why this is so.

Instinct: a behaviour known from birth that occurs without learning

Did the whales make the decision to either stay or swim south, or was this behaviour **instinct**? If this was an instinct, what signal did the whales respond to? Why don't the whales stay in the warmer southern waters all year? The model leaves many unanswered questions, but it does help us predict the most likely behaviour of the whales. Models are very useful in identifying more questions that will help us make more observations, and thus increase our understanding of nature.

Assumption: an idea that we use without proof that it is true

We can develop this model further by explaining that the surviving whales will be the ones that have baby whales. If baby whales respond like their parents, the babies will also survive the winter freeze-up by swimming south. This is an acceptable explanation, but remember that an **assumption** was made. Assumptions often start with the word *if*. We assumed that baby whales responded like their parents.

By doing experiments, scientists may answer some of the questions raised previously. With more knowledge, they will be able to modify the model or develop a more useful model.

Models, like the linkage model about whales, will help you understand the variety of behaviours observed in nature. Remember that a model is based on assumptions and doesn't answer many questions.

You will now practise building linkage models for two different situations.

1. Moths are flying around a campfire. Some fly into the fire and some fly away from the fire.

   STIMULUS: light from the campfire

   Possible RESPONSES:

   - moths fly into the fire

   or

   - moths fly away from the fire

   Possible RESULTS:

   - moths survive

   or

   - moths die (because they burn in the fire)

Use the stimulus, possible responses, and likely results to make two linkages.

a. STIMULUS → RESPONSE → RESULT

_____ _____ _____

_____ _____ _____

b. STIMULUS → RESPONSE → RESULT

_____ _____ _____

_____ _____ _____

2. A houseplant is placed on a ledge near a window. The plant can grow toward the window or away from the window. The window lets in sunlight. The plant needs sunlight to make food for itself.

   Fill in the following blanks.

   STIMULUS: _____

   Possible RESPONSES:

   - _____
   - _____
   - _____

   Possible RESULTS:

   - plant survives

   or

   - plant dies (because it is not able to make food)

   Use the stimulus, possible responses, and likely results to make two linkages.

   a. STIMULUS → RESPONSE → RESULT

   _____ _____ _____

   _____ _____ _____

   b. STIMULUS → RESPONSE → RESULT

   _____ _____ _____

   _____ _____ _____

Check your answers with your learning facilitator.

Activity 2: Instinctive and Involuntary Responses

Involuntary: happening without thought
Body processes that occur without thinking, or as a reflex, are said to be involuntary.

Certain responses are learned. For example, when you were young you learned to cross a busy street when the light turned green. Other responses just happen without you having to learn them. You didn't learn how to breathe. You didn't learn to pull your hand back from very hot water. These responses that occur automatically are called **involuntary** responses. All animals with nervous systems have some kind of involuntary responses.

Many animals have other kinds of unlearned responses that are somewhat more complicated. For example, the way that insects go about finding food can often be quite involved. Yet selecting and finding the appropriate food is something that insects are able to do without being taught. The way in which a bird builds its nest or selects its mate is also unlearned. These are examples of what is called instinctive behaviour. These are animal behaviours that result from instinct. They occur at the appropriate time or when conditions are just right.

For some animal behaviours, we cannot be sure if the behaviour is instinctive or not. Do migrating birds learn to fly south in winter, or is flying south in winter an instinctive response? Is the migration of whales instinctive or learned? Questions such as these are not easy to answer and our ideas sometimes change as scientists gather more information.

This activity will give you some experience in measuring some responses in your body. After being exposed to several stimuli you will measure your pulse rate. To complete this activity you will need either a stopwatch, clock, or watch that measures seconds.

Follow step 1 of the Procedure on page 42 of the textbook, *Science Directions 7*, in order to find the pulse in your wrist. If you have trouble finding the pulse in your wrist, follow the instructions given to find the pulse in your neck. Then return to this activity and continue with steps 1 to 6 which follow.

Caution

If for any medical reason you should not exercise or run on the spot, then have someone else do steps 1 to 6. You can be the recorder and write down the results as you measure their pulse rates.

Steps to Follow

Step 1: Sit still for five minutes. You should read the rest of this activity while you are sitting still. Once five minutes have passed go to step 2.

Step 2: Measure your pulse for one minute. Record your answer in the observation chart under Trial One, the stimulus "sitting still."

Step 3: Repeat the measurement and record in the observation chart under Trial Two, the stimulus "sitting still."

Step 4: Find the average by adding the two measurements together, and then dividing by two. This average is your pulse rate after resting for five minutes.

Now you will change the stimulus and measure your pulse rate again. You are going to try to change your pulse rate just by thinking about it. You should not change anything else.

Step 5: Without changing anything else, try to make your pulse rate increase just by thinking about it. Remain seated in your chair in a resting position. While thinking about increasing your pulse rate, measure it twice and record the measurements on the observation chart. Find the average.

The third stimulus you will try is exercise. You will run on the spot for five minutes, or perform a different exercise that you do regularly. The exercise should be vigorous enough to increase your rate of breathing.

Step 6: Do the exercise of your choice. Measure your pulse rate twice, immediately after doing the exercise. Record the measurements, then find the average.

Observation Chart

Stimulus	Trial One beats per minute	Trial Two beats per minute	Average beats per minute
sitting still			
thinking			
exercise			

Interpretations

1. What was your resting pulse rate after sitting still for five minutes?

2. Were you able to change your pulse rate by thinking about it?

3. How did exercise change your pulse rate?

4. Is pulse rate most likely a learned response, an instinctive response, or an involuntary response?

5. Explain how your observations support your answer to question 4.

Check your answers with your learning facilitator.

Activity 3: Voluntary or Involuntary?

Some responses are difficult to classify as voluntary or involuntary. Breathing is a good example. You can control your breathing rate to a certain extent, but sometimes you cannot control it at all.

This activity will give you observations to show that breathing is sometimes involuntary and sometimes under your control.

Your breathing rate is the number of times you breathe in (inhale) or breathe out (exhale) each minute.

Steps to Follow

Step 1: Sit still and count the number of times you inhale in one minute. Record this number on the observation chart under Trial One, the stimulus "sitting still."

Step 2: Repeat the measurement and record it in the observation chart under Trial Two, the stimulus "sitting still."

Step 3: Find the average by adding the two measurements together, then dividing by two. This average is your pulse rate after resting for five minutes.

Now you will change the stimulus and measure your breathing rate again. You are going to try to change your breathing rate just by thinking about it. You should not change anything else.

Step 4: Without changing anything else, try to double your breathing rate just by thinking about it. Remain seated in your chair in a resting position. Try to double your breathing rate exactly. Measure it twice and record the measurements on the observation chart. Find the average.

The third stimulus you will try is exercise. Choose the same exercise that you did for measuring your pulse rate. Note the caution stated in Activity 3. If for any medical reason you should not exercise or run on the spot, then have someone else do steps 1 to 5. You can be the recorder and write down the results of their breathing rates.

Step 5: Do the exercise of your choice. Measure your breathing rate twice, immediately after doing the exercise. Record the measurements, then find the average.

Observation Chart

Stimulus	Trial One times per minute	Trial Two times per minute	Average times per minute
sitting still			
thinking			
exercise			

Interpretations

1. Explain how your observations support the idea that sometimes you can control your breathing rate, while other times your breathing rate is involuntary.

Check your answers with your learning facilitator.

Activity 4: Experiments Involving Digger Wasps

When scientists study the behaviour of organisms, it is difficult to determine what stimuli are important to organisms. For example, you can't ask a bee why it goes to one kind of flower more often than other kinds of flowers.

Biologists design experiments to test what stimuli are linked with certain responses. Nikolaas Tinbergen, a famous biologist, asked, "When organisms leave their nests or burrows, how do they find their way back again?"

7 Science Directions

Study the information on page 54 of *Science Directions 7* to find out what Dr. Tinbergen did to obtain the answer to his question.

1. In (a) on page 54 of the textbook, why do you think the wasp did not fly away immediately when she came out of her nest?

2. What test was the researcher making in (b) on page 54?

3. Why was the test repeated several times?

4. What was being tested in the set of experiments described under (c) on page 54?

5. Circle the hypothesis that the observations support.

   Hypothesis 1: Digger wasps memorize the shape of the landmark.

   Hypothesis 2: Digger wasps memorize the kind of material the landmark is made of.

   What observations from the experiment support your answer?

   _____

   _____

   _____

Check your answers with your learning facilitator.

Activity 5: Stickleback Responses

Study page 56 of the textbook, *Science Directions 7*, in order to find out how male stickleback fish recognize each other during the mating season.

Think about the experiment with the stickleback; then answer the following questions.

1. Which stimulus do you think causes one male stickleback fish to attack another?

   _____

   _____

2. Why might a male stickleback try to keep other males away from its mate?

   _____

   _____

   _____

3. Fill in the spaces to show a stimulus-response model for male stickleback fish during mating season.

STIMULUS	→	RESPONSE	→	RESULT
_____		_____		_____
_____		_____		_____

Check your answers with your learning facilitator.

Activity 6: Learned Responses

Male sticklebacks seem to be born with the ability to respond to the colour red. They do not change their behaviour with experience, and they do not have to be taught how to respond. This is an example of an instinctive response.

The behaviour of the digger wasp shows another type of response, a very simple form of learned behaviour – an ability to find its way home by memorizing landmarks. This learning came from its own experience. However, most behaviour that is learned comes from imitating a model such as a parent. If the organism does not have a model to learn from, it cannot respond to certain stimuli as do other members of its species.

For an example of learned behaviour that occurs among songbirds, read page 57 of *Science Directions 7*.

7 Science Directions

1. State one behaviour of songbirds that could be classified as a learned response.

_____

_____

2. State evidence which supports your answer.

_____

_____

Discuss your answers with your learning facilitator.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

A stimulus is a change in the environment that causes a response. For example, if you hear a phone ring (stimulus) you are likely to answer the phone (response).

1. Match up the most likely response for each stimulus by writing the letter of the response in the space provided.

STIMULUS	RESPONSE
_____ it is snowing outside	a. wake up in the morning
_____ a bright light flashes on	b. pull your hand back quickly
_____ the alarm clock rings	c. put on a hat and mitts
_____ the garbage begins to smell	d. open the door
_____ you touch a hot object	e. take the garbage outside
_____ the doorbell rings	f. close your eyes suddenly

The way that an organism responds to change is explained by an important but simple model.

Examine the diagram on page 48 of *Science Directions 7*.

The diagram shows a boy pulling his hand back from a hot stove. The heat from the stove is the *stimulus*. The stimulus is a change in the environment. In this case the boy's hand sensed the heat from the stove. The stimulus is the first part of the model.

The boy's reaction, or *response*, was to pull his hand back quickly. If this has happened to you, you will realize that you automatically pull your hand back without stopping to think about what the best action would be. The response is the second part of the model.

The last part of the model is the *result*. The two possible results for this example are that the boy's hand is burned, or that the boy's hand is not burned. To build a stimulus-response model, you must first identify the parts.

- STIMULUS: heat from stove

Possible RESPONSES

- the boy pulls his hand back

or

- the boy leaves his hand near stove

Possible RESULTS

- the boy's hand is burned

or

- the boy's hand is not burned

To complete the model, link the stimulus with a response and the most likely result of that response. For this example, the most likely result of pulling the hand back is that it is not burned. The hand will most likely be burned if it is left near the stove.

Here are two possible linkages.

- STIMULUS (heat from the stove) → RESPONSE (boy pulls hand back) → RESULT (boy's hand is not burned)

- STIMULUS (heat from the stove) → RESPONSE (boy leaves hand near stove) → RESULT (boy's hand is burned)

The situation just described is simple, but it is a good example of how to use the stimulus-response model. The two linkages show that the boy benefits from pulling his hand back from the stove. Now try to build a model for the following situation.

2. White-tailed deer can often be found grazing on grass. If a hunter approaches the deer with the wind blowing from the hunter towards the deer, the deer can often sense the hunter's approach.

   Fill in the following spaces.

   a. STIMULUS: _____

   b. Possible RESPONSES:

   - _____
   - _____

   c. Possible RESULTS:

   - _____
   - _____

   Use the stimulus, possible responses, and possible results to make two linkages.

   d. STIMULUS → RESPONSE → RESULT

   _____ _____ _____

   _____ _____ _____

   e. STIMULUS → RESPONSE → RESULT

   _____ _____ _____

   _____ _____ _____

Check your answers with your learning facilitator.

7 Science Directions

Enrichment

Read page 48 of *Science Directions 7* and observe what is happening in the picture. Using the picture, identify the stimulus. Then identify possible responses the boy may make and what the results might be.

1. STIMULUS: _____

2. Possible RESPONSES:

   - _____
   - _____

3. Possible RESULTS:

   - _____
   - _____

4. Use the stimulus, possible responses, and possible results to make two linkages.

   a. STIMULUS → RESPONSE → RESULT

   _____ _____ _____

   _____ _____ _____

   b. STIMULUS → RESPONSE → RESULT

   _____ _____ _____

   _____ _____ _____

Did you know that different parts of the brain control different body functions? The human brain can receive up to 100 million signals each second! For many of the signals, the body responds automatically.

In Activity 3 you found that breathing is both a voluntary response and an involuntary response. Breathing rate increases automatically when you exercise, but you can also intentionally increase or decrease your breathing rate.

Read The Senses Our Lives Depend On on page 49 of *Science Directions 7*.

5. Describe the stimulus and the response which causes you to keep breathing.

   a. Stimulus: _____

   _____

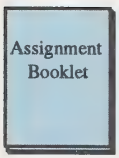
   b. Response: _____

   _____

Check your answers with your learning facilitator.

Conclusion

Living things respond to changes around them. A change that causes a response is called a stimulus. All plants and animals respond to stimuli. Scientists try to explain how organisms respond by making stimulus-response models, and by classifying stimulus-response patterns as learned or instinctive.



ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 6.

Note: After you have completed the assignment for Section 6, read the Module Summary which follows.

MODULE SUMMARY

In this module you learned living things are called organisms. To be classified as an organism, something must have all of the following characteristics:

- All organisms grow.
- All organisms move (change shape, position, or place).
- All organisms reproduce.
- All organisms respond to changes in their environment.
- All organisms produce or take in food.

You should also know that life-cycle models have been developed to compare the growth stages of different species. Reproduction is the step that links one generation to the next.

Structural adaptation and behavioural adaptation are ideas that help us make sense of the variety and complexity of the natural world.

Scientists try to explain how organisms respond by making stimulus-response models, and by classifying stimulus-response patterns as learned, instinctive, or involuntary.

You have learned that to answer questions in science you should start with observations. Inferences are explanations that help us understand the variety and complexity of living things. Inferences, like hypotheses, are supported, modified, or rejected, depending on further observations collected by experimentation. Classifying helps show patterns and trends. Models help make sense out of observations and inferences. Models are useful in identifying further questions.

Appendix

Glossary

Alive
- showing signs of life

Assumption
- an idea that we use without having proof that it is true

Behaviour
- the way an organism acts under certain conditions

Behavioural adaptation
- a change in the way an organism reacts towards a change in its environment

Camouflage
- the ability of an organism to hide in its environment and look almost invisible

Characteristic
- a feature that is common to all members of a group

Classification
- the placement of things that are alike in some way into groups

Controlled experiment
- a science investigation in which only one variable is changed by the experimenter; sometimes called a *fair test*

Dead
- no longer alive

Hibernation
- a period of seasonal activity in which an animal passes the winter in a resting state

Hypothesis
- a statement to explain a natural event or to predict what will happen in a certain situation; plural form is hypotheses

Inference
- a possible explanation for something observed

Inferring
- interpreting observations; deciding what the observations mean

Instinct
- a behaviour known from birth that occurs without learning

Investigation
- the process of finding information about something by searching carefully or examining in detail

Involuntary
- happening without thought
  Body processes that happen without conscious thought, or as a reflex, are said to be involuntary.

Life cycle	• a model that shows the different stages in the development of an organism
Living	• being alive or having been alive
Migration	• the temporary movement of organisms from one area to another, and then returning back to the original area
Model	• a diagram or description that helps make sense out of a collection of related observations
Non-living	• never having been alive
Observation	• information gathered by using the five senses
Organism	• a living thing; anything that is alive
Prediction	• an opinion about what might happen on the basis of previous observation and experience
Reproduction	• the process of organisms producing offspring similar to themselves
Response	• a reaction to some change in the environment
Result	• a consequence; that which follows from a given situation
Species	• a group of organisms that closely resemble each other and can reproduce new organisms of the same kind
Stimulus	• a change that causes a reaction; plural form is stimuli
Structural adaptation	• a special body part that helps an organism survive in its surroundings
Variable	• a condition that is allowed to change in an experiment
Variation	• differences among individual members of a species, such as differences in size, shape, colour, or behaviour

N.L.C. - B.N.C.
3 3286 10838955 8

Science 7

9SC07P11

L.R.D.C.
Producer

FIRST EDITION
1991